इंटरनेट मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 9153 (1978): Methods of polariscopic examination of glassware [CHD 10: Glassware]

"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

Act Number 22 of 2005
The Indian Parliament
RIGHT TO INFORMATION

Made Available By
Public.Resource.Org

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

BLANK PAGE

BRUTUM FULMEN

IGNORANTIA
JURIS
NON EXCUSAT

PROTECTED BY COPYRIGHT

IS : 9153 - 1978
(Reaffirmed 1998)

Indian Standard

METHODS OF POLARISCOPIC EXAMINATION OF GLASSWARE

UDC 666·17 : 535·568 : 681·785·3

© *Copyright* 1979

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

~~*Price Rs* 5·00~~ [illegible]

August 1979

IS : 9153 - 1978

Indian Standard

METHODS OF POLARISCOPIC EXAMINATION OF GLASSWARE

Glassware Sectional Committee, CDC 10

Chairman	*Representing*
Shri K. D. Sharma	Central Glass & Ceramic Research Institute (CSIR), Calcutta
Members	
Dr S. Kumar (*Alternate* to Shri K. D. Sharma)	
Shri C. G. Amin	Alembic Glass Industries Ltd, Vadodara
Shri V. R. Bhide	Victory Flask Co Pvt Ltd, Bombay
Shri D. S. Chabhal	Directorate General of Technical Development, New Delhi
Deputy Director Standards (Carriage), RDSO, Lucknow	Ministry of Railways
Shri A. R. Dey	Ministry of Defence (R & D)
Shri L. S. Bharaj (*Alternate*)	
Dr B. B. Gaitonde	Haffkine Institute, Bombay
Shri Y. S. Nimbkar (*Alternate*)	
Shri S. P. Gupta	Hindustan Pilkington Glass Works Ltd, Calcutta
Dr V. P. Maheshwary	Development Commissioner (Small Scale Industries), New Delhi
Shri K. K. Saran Aggarwal (*Alternate*)	
Shri C. K. Mehrotra	Export Inspection Council of India, Calcutta
Shri O. P. Dhamija (*Alternate*)	
Shri Rajinder Singh	Empire Dyeing & Mfg Co Ltd (Vitrum Glass Division), Bombay
Shri R. C. Singhal (*Alternate*)	
Dr A. V. R. Rao	National Buildings Organization, New Delhi
Shri G. T. Bhide (*Alternate*)	
Shri P. R. Rao	Borosil Glass Works Ltd, Bombay
Shri A. K. Bansal (*Alternate*)	
Shri J. R. Sachdeva	Ministry of Defence (DGI)
Dr S. P. Singh Dhakaray (*Alternate*)	
Shri R. Sahai	Hindustan Vacuum Glass Ltd, Faridabad
Shri Vinod Ahuja (*Alternate*)	

(*Continued on page* 2)

© *Copyright* 1979
INDIAN STANDARDS INSTITUTION
This publication is protected under the *Indian Copyright Act* (XIV of 1957) and reproduction in whole or in part by any means except with written permission of the publisher shall be deemed to be an infringement of copyright under the said Act.

(*Continued from page* 1)

Members	*Representing*
Dr J. M. Sehgal	Indian Drugs & Pharmaceuticals Ltd, New Delhi
Shri V. P. Sharma	J. G. Glass Industries Ltd, Pune
Shri S. K. Gupta (*Alternate*)	
Shri K. Shimizu	Indo-Asahi Glass Co Ltd, Calcutta
Shri S. B. Prasad (*Alternate*)	
Shri U. V. Singh	Indian Chemical Manufacturers' Association, Calcutta
Shri C. K. Somany	Hindustan National Glass and Industries Ltd, Calcutta
Shri R. K. Gupta (*Alternate*)	
Shri J. A. Taktawala	Shree Vallabh Glass Works Ltd, Bombay
Shri C. A. Taktawala (*Alternate* I)	
Shri H. C. Patel (*Alternate* II)	
Dr G. M. Saxena, Director (Chem)	Director General, ISI (*Ex-officio Member*)

Secretary

Shri G. P. Saraswat
Deputy Director (Chem), ISI

Methods of Test for Glass and Glassware Subcommittee, CDC 10 : 1

Convener	
Dr S. Kumar	Central Glass & Ceramic Research Institute (CSIR), Calcutta

Members	
Shri S. V. Bhatye	Central Glass & Ceramic Research Institute (CSIR), Calcutta
Dr C. R. Das	Alembic Glass Industries Ltd, Vadodara
Dr S. P. Singh Dhakaray	Ministry of Defence (DGI)
Shri N. C. Bose (*Alternate*)	
Shri P. R. Rao	Borosil Glass Works Ltd, Bombay
Shri A. K. Bansal (*Alternate*)	

Indian Standard

METHODS OF POLARISCOPIC EXAMINATION OF GLASSWARE

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 30 December 1978, after the draft finalized by the Glassware Sectional Committee had been approved by the Chemical Division Council.

0.2 The apparent temper as determined by the methods given in this standard depends primarily on the magnitude and distribution of strain in glass, the thickness of glass (optical path), and to a minor extent on the composition of glass. According to this standard annealing is to be reported (*see* **5.1**) as the temper number, number of discs or degree of rotation of the analyzer in accordance with the tabulations given in **3.2.1.1** and **4.2.1.1** but the interpretation of this apparent temper in terms of real temper requires consideration of the above factors in addition to the practical experience with the particular ware being evaluated.

0.3 In the formulation of this standard due weightage has been given to international co-ordination among standards and practices prevailing in different countries in addition to relating it to the practices prevailing in the field in this country. This has been met by basing the standard on ASTM Standard C 148-1965 (Reapproved 1971) ' Methods of polariscopic examination of glass containers', issued by the American Society for Testing and Materials, USA.

0.4 In reporting the result of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

1. SCOPE

1.1 This standard prescribes methods of polariscopic examination of glassware for determining the relative annealing strain in them.

---

*Rules for rounding off numerical values (*revised*).

1.1.1 Two methods are prescribed. Method A is based on comparison with standard strain discs using a polariscope and Method B on measurement of strain using a polarimeter.

2. SAMPLING

2.1 Representative samples of glassware shall be drawn as specified in respective material specification.

3. METHOD A — COMPARISON WITH STANDARD STRAIN DISCS USING A POLARISCOPE

3.0 General — For wares having strain greater than temper No. 6, evaluation may be done using polarimeter (*see* Method B in **4**).

3.1 Apparatus

3.1.1 *Polariscope* — conforming to the following requirements:

a) The high brightness of the field shall be at least 308 cd/m^2 at the point where glassware is held for examination and at least 171 cd/m^2 at the edge of the field as observed with the polarizing element and protective element in operating position;

b) The degree of polarization of the field at all points shall not be less than 99·0 percent;

c) The field shall be of sufficient size to permit the examination of the whole ware 25 cm in height at one viewing; and

d) A sensitive tint plate standardized to give an optical retardation of 565 nm shall be used.

3.1.2 *Standard Strain Discs* — Such discs shall be circular plates of glass between 7·5 and 10 cm in diameter and having nominal residual strain (about 6 mm from the edge) corresponding to not less than 21·8 nm and not more than 23·8 nm of optical retardation.

NOTE 1 — In standardizing such discs for measurement or calibration, error shall not exceed 0·7 nm.

NOTE 2 — A set of 5 such discs which could be useful in covering the range of annealing of commercial glass containers is generally available from the Central Glass and Ceramic Research Institute (CSIR), Calcutta 700032.

3.2 Procedure

3.2.1 *Examination of Base of Cylindrical Glassware* — Rotate the analyzer so as to have its plane of polarization perpendicular to that of the polarizer. The field should look black. Introduce the container in the field of vision and view its base through the neck. Compare the maximum broad colour pattern in the base of the container with the maximum colour in various numbers of the standard strain discs stacked one on top of the other to determine whether the maximum amount of colour in the base is less than that in one disc, greater than one but less than two; greater than two but less than three; etc.

NOTE — It is seldom possible to obtain an exact match of the colour of container with the reference standards.

3.2.1.1 Record the temper number of the container in accordance with the following rule.

Rule — When the colour of a container is greater than the equivalent number (N) of discs but less than $N + 1$ discs, the grade is $N + 1$; that is, corresponding numerically to the larger number of discs, as follows:

Temper No.	*Equivalent Number of Discs*
1	Less than 1 disc
2	Less than 2 but greater than 1 disc
3	Less than 3 but greater than 2 discs
4	Less than 4 but greater than 3 discs
5	Less than 5 but greater than 4 discs
6	Less than 6 but greater than 5 discs

NOTE — Each disc has an optical retardation of about 22·8 nm at the calibration point about 6 mm from the edge. In practice each disc has an effective maximum optical retardation of about 23·7 nm near the edge.

3.2.2 *Examination of Square, Oval and Irregular Shapes* — Make the polariscopic examination at the curve or corner that shows the most colour, and record the temper number in accordance with the rule given in **3.2.1.1**.

3.2.3 *Examination of Sidewalls* — Match the maximum colour of any part of the sidewall with the maximum colour in any part of the discs, and record the temper number in accordance with the rule given in **3.2.1.1**.

3.2.4 *Examination of Coloured Ware* — Using the polariscope with the tint plate [*see* **3.1.1**(d)] removed, look at the base of the container through the neck and select for reference the darkest area (usually the centre of the base), then, with the tint plate in place hold a standard disc under the base of the container so that the portion of the edge of the disc, which shows maximum colour, is underneath the reference areas. Compare the colour of the reference area as modified by the presence of the disc with the maximum colour in the edge of the base. Rotate the container to find the point giving maximum colour. If this colour is greater than the modified colour in the reference area, use two or more discs and grade the annealing in accordance with the rule given in **3.2.1.1**.

4. METHOD B — DETERMINATION OF APPARENT TEMPER WITH A POLARIMETER

4.1 Apparatus

4.1.1 *Polarimeter* — conforming to the following requirements:

a) The high brightness of the field shall be at least 308 cd/m² at the point where the glassware is held for examination and at least 171 cd/m² at the edge of the field, as observed with the polarizing element and protective element in operating position;

b) The degree of polarization of the field at all points shall not be less than 99·0 percent;

c) The field shall be of sufficient size to permit the examination of the whole ware 25 cm in height at one viewing;

d) The source of light shall consist of 75 or 100 W incandescent lamp bulbs so arranged as to satisfy the brightness requirements stated in (a) above;

e) A quarter-wave plate with an optical retardation of 141 nm shall be inserted between the polarizer and the analyzer with its slow axis at 90° to the plane of polarization of the polarizer; and

f) The analyzer shall be so mounted that it can be rotated with respect to the polarizer and quarter-plate, and the angle of rotation determined.

4.2 Procedure

4.2.1 *Examination of Base of Cylindrical Glassware* — Rotate the analyzer so as to have its plane of polarization perpendicular to that of the polarizer. This is the zero position and the field should be black. Introduce the container in the field of vision and view the bottom through the neck. A dark cross will appear in the field between the areas which would show colour in a tint plate polariscope. In containers with low temper number, this cross will be hazy and indistinct. Rotating the analyzer causes the dark cross to separate into two areas which proceed outward in opposite directions towards the heal of the container. As these dark areas move outward, they develop a blue-grey colour on the concave side and a brown colour on the convex side. In measuring the birefringence of a selected point in a container, rotate the analyzer until the blue-grey colour is just displaced by the brown colour at the selected point. Rotate the container itself about its own axis to determine if the region of maximum birefringence has been selected; if not, rotate the analyzer further to displace the blue-grey colour with the brown in the region of maximum birefringence.

4.2.1.1 Convert the angle of rotation of the analyzer to temper number as follows:

Temper No.	*Analyzer Rotation, Degrees*
1	0·0 to 7·4
2	7·5 to 14·9
3	15·0 to 22·4
4	22·5 to 29·9
5	30·0 to 37·4
6	37·5 to 44·9
7	45·0 to 52·4
8	52·5 to 59·9
9	60·0 to 67·4
10	67·5 to 74·9

NOTE — One degree of rotation of the analyzer is equivalent to about 3·14 nm optical retardation when using a white light source as specified in **4.1.1**(d) (effective wave-length approximately 565 nm). Thus, the equivalent value is taken to be 7·5° rotation for disc as used in Method A.

4.2.2 *Examination of Square, Oval and Irregular Shapes* — Make the examination at the curve or corner that reveals the most birefringence when examined in accordance with the procedure given in **4.2.1**.

4.2.3 *Examination of Sidewalls* — Introduce the container in the polarimeter with its axis at 45° to the plane of polarization. No dark crosses will be apparent. Rather, broad areas of varying lightness and darkness will be visible in the container. In this case, rotate the analyzer until the dark shadows converge on and displace the last remaining light areas in the sidewalls. It may be necessary to rotate the container about its own axis to determine the areas of most birefringence. Convert the degree of rotation of the analyzer to temper number in accordance with **4.2.1.1**.

4.2.4 *Examination of Coloured Ware* — Use the same procedure as in **4.2.1**. It is more difficult to distinguish the end point in coloured ware, particularly in darker colours, because of the absence of the characteristic blue and brown and also because of the lower level of light intensity. In dark samples the most accurate indication of the end point is obtained by averaging the rotation necessary to displace the light area with dark and the total rotation necessary to just make the light area reappear.

5. REPORT

5.1 The report shall include the temper number, number of standard strain discs, or degrees of rotation of the analyzer, as the case may be, for each container.